

WHAT IS CLAIMED IS:

1. A thin film magnetic memory device, comprising:
a memory array having a plurality of memory cells for magnetically storing data, wherein
each of said memory cells includes a magnetic storage portion for storing data when being magnetized in one of two directions,
5 said thin film magnetic memory device further comprising:
a plurality of program registers each storing a one-bit program signal for use in programming of information used in operation of said thin film magnetic memory device, wherein
10 each of said program registers includes at least one program element having an electric resistance varying according to a magnetization direction thereof,
said electric resistance of said program element is capable of being fixed with physical breakdown operation.
2. The thin film magnetic memory device according to claim 1, wherein
each of said program registers has either a first or second electric resistance when being magnetized in a direction according to a
5 corresponding one-bit program signal stored in the program register, and
after said breakdown operation, said electric resistance of each of said program registers is fixed to a third electric resistance that falls within a range other than that between said first and second electric resistances.
3. The thin film magnetic memory device according to claim 2, wherein
one of said first and second electric resistances corresponds to one of an initial state and a program state, and the other electric resistance
5 corresponds to the other state, said initial state being a state before program data write operation, and said program state being a state after said program data write operation, and

said third electric resistance corresponds to a prescribed one of said initial state and said program state, which is set in an irreversible manner.

4. The thin film magnetic memory device according to claim 2, wherein said third electric resistance is lower than said first and second electric resistances.

5. The thin film magnetic memory device according to claim 1, wherein

each program element includes

a first magnetic layer magnetized in a fixed direction,

5 a second magnetic layer magnetized either in a same direction as, or an opposite direction to, that of said first magnetic layer according to said data and said program signal to be stored, respectively, and

an insulating film formed between said first and second magnetic layers, and

10 said insulating film is subjected to dielectric breakdown by said breakdown operation.

6. The thin film magnetic memory device according to claim 5, wherein

each of said program registers further includes a sensing circuit for applying a prescribed voltage between said first and second magnetic layers of said at least one program element and reading said one-bit program signal according to a current passing through said at least one program element, and

10 in said breakdown operation, a voltage having a same polarity as that of said prescribed voltage and having an absolute value greater than that of said prescribed voltage is applied between said first and second magnetic layers.

7. A thin film magnetic memory device, comprising:

a memory array having a plurality of memory cells arranged in a

matrix, for magnetically storing data, wherein

each of said memory cells includes a magnetic storage portion for
5 storing data when being magnetized in one of two directions,

said thin film magnetic memory device further comprising:

a plurality of program registers each storing a one-bit program signal
for use in programming of information used in operation of said thin film
magnetic memory device, wherein

10 each of said program registers includes

program elements each having either a first or second electric
resistance according to a magnetization direction thereof,

a comparative resistor portion having an intermediate electric
resistance of said first and second electric resistances, and

15 a sensing circuit for reading a corresponding one-bit program
signal based on comparison between electric resistances of said program
element and said comparative resistor portion, and

either a first or second locking operation is capable of being
selectively conducted, wherein said first locking operation is an operation
20 for irreversibly fixing said electric resistance of said program element to a
third electric resistance that falls within a range other than that between
first and second electric resistances by physical breakdown operation of said
program register, and said second locking operation is an operation for
irreversibly fixing said electric resistance of said comparative resistor
25 portion to a fourth electric resistance that falls within a range other than
that between said first and second electric resistances by physical
breakdown operation of said comparative resistor portion.

8. The thin film magnetic memory device according to claim 7,
wherein

each program element includes

a first magnetic layer magnetized in a fixed direction,

5 a second magnetic layer being magnetized either in a same
direction as, or an opposite direction to, that of said first magnetic layer
according to said data and said program signal to be stored, respectively,

and

10 an insulating film formed between said first and second
magnetic layers,

 said third electric resistance is lower than said first and second
electric resistances, and

 said insulating film is subjected to dielectric breakdown in said first
locking operation.

 9. The thin film magnetic memory device according to claim 7,
wherein

 said fourth electric resistance is higher than said first and second
electric resistances, and

5 said comparative resistor portion has a resistance element that is
blown in said second locking operation.